EXTENDED ABSTRACT – MARITIME HAZARD ANALYSIS AND MAP PRODUCTION IN CALIFORNIA

By Patrick Lynett, University of Southern California, Tsunami Research Center (USC); Rick Wilson, California Geological Survey (CGS); and Kevin Miller, California Emergency Management Agency (Cal EMA)

The objective of this three-year project is to develop tsunami flood and hazard maps for harbors, marinas, and bays in California that will assist harbor planning, reduce exposure, and improve the resiliency of the maritime community (ships and harbor infrastructure) against tsunami hazards. Portions of the project are being funded by NOAA through the National Tsunami Hazard Mitigation Program (NTHMP), and FEMA through a Cooperative Technical Partnership with the State of California. There are three key elements to this project: 1) completion of tsunami hazard maps within harbors and bays that identify areas of strong currents, significant tidal fluctuations, and where relative safe areas exist; 2) development of safe zones for seagoing vessels to evacuate to offshore during large, potentially damaging tsunamis; and 3) generation of guidance for how to apply these products and outreach efforts to help implement improved maritime planning. The activities of the first year (2011-12) of this project have included: 1) initial validation/calibration current velocity data from numerical tsunami models using the 2010 Chilean and 2011 Japan tsunami dataset; 2) preliminary development of tsunami flood and hazard maps for six locations as pilots for statewide mapping, and 3) development of a tsunami awareness and preparedness brochure for recreational and commercial boaters.

Numerous numerical simulations by USC are providing a detailed construction of the possible tsunami-induced currents within and offshore of select ports and harbors: Crescent City Harbor, Santa Cruz Harbor, Ventura Harbor, Port of Long Beach, Port of Los Angeles, and San Diego Bay. For each location, 4-5 different tsunami sources will be included. The simulation approach has two tracks. First, the complete set of simulation setups are being run at 90m, 30m, and 10m resolution with USC's MOST model, which has been the standard tsunami model for inundation mapping in California. Next, for each location and source, a high-resolution, high-order physics Boussinesq model is being run as well; this Boussinesq model has also been created by researchers at USC. The Boussinesq model provides the best available result in terms of physical accuracy, and, along with video/eye-witness information, will be compared with the MOST output to determine the significance of the model differences, and how effectively the existing large database of MOST current output might be used in a more widespread manner in California.

For each of the performed simulations, event-maximum current maps and time-based current-threshold maps will be generated. The latter maps provide the length of time after the initial wave arrival that the current no longer will exceed a certain threshold. For example, a 4 knot threshold map for a harbor would indicate that in some locations the current never exceeds 4 knots during the event, in some locations 4 knots will not be exceeded 1 hour after the first waves, and in other locations 4 knots will be exceeded for 8 hours after the first waves; essentially a "safe time" map. Similarly, "safe zones" will be identified offshore where model results indicate low potential for tsunami-related hazards. By 2014,

maps of similar content will be produced for all harbors and marinas statewide, and be added to FEMA's RiskMAP data platform.

Based on recent analyses performed by Wilson *et al* (2012a, 2012b) after the 2011 Japan tsunami in California, resituating boats and relocating harbor structures and infrastructure prior to a tsunami's arrival could help mitigate millions of dollars in damage and likely prevent injuries and loss of life. This maritime project will not only help define tsunami mitigation and preparedness activities for maritime communities in California, but also could form the basis for production of guidance and similar products for other state partners in the NTHMP. The NTHMP is integrating evaluation of California's project into its FY2013-17 Strategic Plan. For this reason, and because this is groundbreaking work, this project has become a potential national "pilot" for leading the way towards tsunami hazard mitigation within maritime communities.

References:

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